Tahitian *Isochrysis* aff. *galbana*, and *Pseudoisochrysis paradoxa* were tested for larval *Penaeus orientalis.* The algae were semi-continuously cultured in 5,000 ml carboys with 4,000 ml of Guillard f/2 medium, under 2,000 lux continuous light and under aeration. The algal density was up to 1×10^7 cell/ml. Rearing experiments were conducted in round tanks with diameter of 45 cm. Algal density was controlled at 1×10^5 cell/ml in the course of the experiments. The larval density was 18 individual/100 ml; water temperature, 21-24°C; pH, 7.5-7.7; and sea water specific gravity, 1.019.

The results showed that of five clones used, Tahitian *I.* aff. *galbana* and *D. zhangjiangensis* proved to be the best. It took 9-11 days for nauplius I to develop into mysis I with survival rate of 73.5% and 73.4%, respectively.

The Tolerance of *Penaeus monodon* Eggs and Larvae to Fungicides against *Lagenidium* sp. and *Haliphthoros philippinensis*

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The *in vivo* effect of mycostatic levels of fungicides against the fungi *Lagenidium* sp. and *Haliphthoros* sp. were tested on *Penaeus monodon* eggs and larvae. Hatching rate and survival of nauplii, zoeae, myses and postlarvae exposed to 10 mg/ℓ Benzalkonium chloride, 1 mg/ℓ Clotrimazole, 1 mg/ℓ Crystal Violet, 10 mg/ℓ 2,4-D, 10 mg/ℓ Daconil, 20 mg/ℓ laundry detergent, 1 mg/ℓ Econazole nitrate, 10 mg/ℓ Resiguard, 0.2 mg/ℓ and 10 mg/ℓ Treflan-R, 0.01 mg/ℓ and 0.2 mg/ℓ Trifluralin were monitored daily for 96 hr in a static bioassay in glass aquaria. Results showed that all test chemicals had no inhibitory effect on hatching rate but survival rate of hatched nauplii was significantly reduced in most treatments except that of 0.2 mg/ℓ Treflan-R. Tests with zoeae, myses and postlarvae indicated that 0.2 mg/ℓ Treflan-R and 0.01 mg/ℓ and 0.2 mg/ℓ Trifluralin did not adversely affect survival. In addition, Benzalkonium chloride caused no significant mortalities among exposed myses.

Growth and Survival of *Penaeus monodon* Postlarvae with Different Feeding Regimes and Stocking Densities in Earthen Brackishwater Nursery Ponds

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The effect of different stocking densities (50, 100 and 150/m^2) and two feeding regimes (natural food, consisting mainly of lablab, and natural food plus artificial diet) on the growth and survival of *Penaeus monodon* postlarvae (PL_4 to PL_5) were evaluated in eighteen 40 m^2 earthen brackishwater nursery ponds using tidal water exchange for a period of 45 days.

Results of the experiment indicated that the effect of different stocking densities was highly significant ($P<0.01$) on growth but not on survival for the two feeding regimes. Likewise, no interaction effect was discerned. Shrimps given artificial feed (Treatments II, IV and VI) obtained higher mean weight gains of 1.55, 1.17 and 1.05 g, respectively, than those that were not given artificial feed (I-1.44 g, III-0.92 g, and V-0.66 g). Similarly, those reared with artificial feed attained better survival of 41.62% (II), 67.44% (V) and 52.14% (VI) compared to shrimp that were not given artificial feed (I-42.53%, III-54.61% and V-46.90%).

An exploratory economic study showed that the nursery operation gave promising results in all treatments. High rate of investment (ROI) was obtained to give a safe margin for the risk involved in this kind of business. Among all treatments, treatment V had the highest ROI of 693% and shortest payback period of 0.19 years.

Intermediate Culture of Chinese Prawn Without Feeding in Nursery Ponds

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The aim of the experiments is to find a new way to accomplish intermediate culture of the penaeid prawn in nursery ponds. Experiments have been carried out in prawn farms in Haiyang County, Shandong Province. Prawn fry were stocked at high density in a nursery pond. Commercial fertilizer was added to the nursery pond to fertilize the pond water as nutrients for the planktonic and benthic organisms. The prawn fry in the pond fed only on the available natural food organisms without any special feed supply and grew normally. The survival and growth rate of the prawn fry are discussed.

Survival, Growth and Production of White Shrimp *Penaeus indicus* in Brackishwater Ponds

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This study was conducted in 4 one-ha ponds, 70-100 cm deep and 2 two-ha ponds, 40-70 cm deep to evaluate the survival, growth and production of white shrimp, *Penaeus indicus* stocked at 50,000/ha and cultured within a period of 90 days with supplementary feeding.

It was observed that mean survival and yield per ha obtained were significantly higher in deeper ponds, 70.36% and 343.2 kg/ha, respectively, compared with those in shallow ponds, 37.50% and 180 kg/ha, respectively ($P < 0.05$). There was no significant difference in mean body weight at harvest for deep ponds (9.80 g) and shallow ponds (9.55 g). Results suggest that white shrimp production is better in deeper ponds than in shallow ponds.

Effect of Dietary Fatty Acids on the Fatty Acid Composition of *Penaeus monodon* Juveniles

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Six purified diets containing either pollack liver oil or a combination of dietary fatty acids (18:1ω9, 18:3ω3, 20:5ω3) at 5% level and a control (no lipid) were assessed for their influence on the fatty acid composition of *Penaeus monodon* juveniles (0.2-0.5 g). After a 35-day feeding period, the fatty acid composition of the neutral lipid (NL) and polar lipid (PL) fractions of prawn total lipids was analyzed. All treatments showed that the prawn lipid contained high level of polyenoic acids (20:4ω6, 20:5ω3, 22:6ω3); likewise the sum of ω3 series fatty acids were high in the PL fraction. The component fatty acids of prawns showed a correlation with those of the diet. However, some dietary fatty acids were incorporated more into the NL fraction (18:1ω9, 20:5ω3) than in the PL fraction (20:4ω6). The ratios of 18:1ω9/22:6ω3 and (18:1ω9 + 20:1ω9)/(20:5ω3 + 22:6ω3) were found to be the lowest in the PL of the prawn pollack liver oil.

Lipids and Essential Fatty Acids in the Nutrition of *Penaeus monodon* Larvae

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Total lipid levels and fatty acid distribution during larval development of *Penaeus monodon* were determined. Larvae were cultured utilizing standard rearing procedures and feeding schemes adopted by the Crustacean Hatchery of SEAFDEC Aquaculture Department in Tigbauan, Iloilo, Philippines. At each developmental stage (spawned egg, nauplius, protozoea, mysis, postlarva), samples were collected for biochemical analysis.

Lipid content decreased with developmental stage (from egg to postlarva), indicating utilization of lipids as energy source during larval development and metamorphosis. The major fatty acids in the egg lipid were 16:0 (palmitic), 16:1 (palmitoleic), 18:0 (stearic), 18:1 (oleic), 18:3 (linolenic), 20:4 (arachidonic), 20:5 (eicosapentaenoic), and 22:6 (docosahexaenoic acids. As the larvae developed, levels of 16:1 and 18:1 fatty acids decreased with a corresponding increase in polyunsaturated fatty acids (PUFA), particularly 20:5ω3 and 22:6ω3. These indicate the importance of PUFA as dietary components.

Comparison was made between fatty acid changes during larval development and the fatty acid constituents of commonly used larval feeds (algae, rotifer, brine shrimp, egg yolk) for *P. monodon*. The algae and zooplankton were found to contain 20:5ω3, while egg yolk was high in total lipids but low in polyunsaturates. Most larval diets were deficient in 22:6ω3 fatty acid.

Crustaceans have been shown to have a limited capacity to biosynthesize long-chain PUFA; these have to be provided in their diet. These essential fatty acids must be available in appropriate amounts to ensure successful larval development and survival.

Lecithin Requirement of *Penaeus monodon* Juveniles

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An 8-week feeding experiment was carried out to determine the lecithin requirement of *Penaeus monodon* postlarvae. Six shrimps with initial mean weight of 0.11 g were stocked in oval fiberglass tanks in a flowthrough system with 40 ℓ of seawater. There were 5 replicates or a total of 30 shrimps per treatment. Diets were similar for all treatments except for the source of lipid and levels (0, 1 and 2%) of added soybean lecithin. Cod liver oil (treatments 1 to 3), crude degummed soybean oil (treatments 4 to 6) and refined soybean oil (treatments 7 to 9) were the three sources of lipid.

Differences in mean weight gain due to source among treatments were not significant after the fourth week of feeding but were significant after the sixth week. Mean survival rate was affected by source of lipid after the fourth and sixth weeks. Levels of lecithin significantly affected mean weight gain after the fourth and sixth week of feeding. Mean survival rate was significantly different among treatments after the sixth but not the fourth week. Although feed conversion or feed efficiency was generally poor, a trend is discerned. Feed conversion improved as dietary levels of lecithin increased from 0 to 2%. *P. monodon* juveniles need lecithin but the amount has yet to be defined.